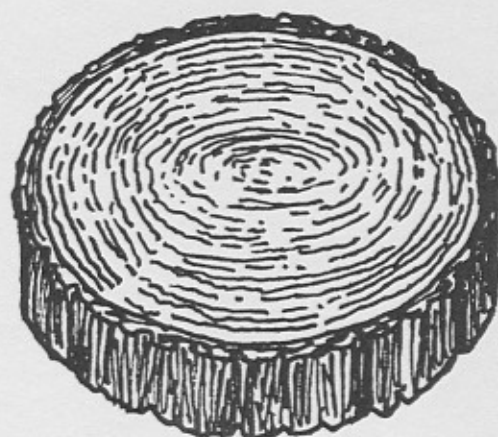


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DIAMETER GROWTH FOLLOWING AN UNDERSTORY PRESCRIBED BURN



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By: Thomas A. Dierauf

ABSTRACT

A maintenance burn was done in 1984 on a 2-acre plot in an 11-year-old loblolly pine progeny test under extremely dry conditions. The fire later escaped and burned very hot. Between the test plot and the "hot spots" of the escaped fire, crown scorch varied from 0 to 100 percent. Percent crown scorch was estimated on 351 trees soon after the burn and DBH to the nearest .1 inch was measured soon after the burn and at the end of the growing season, from 1984 through 1988.

Trees with 90 percent or less crown scorch had little mortality, but over half the trees with 100 percent crown scorch died. Diameter growth during the first year following the burn was strongly related to crown scorch, but, after 4 years, differences related to crown scorch had disappeared.

INTRODUCTION

On June 20, 1984, we carried out a small test burn in an 11-year-old loblolly pine progeny test plantation on the Appomattox-Buckingham State Forest in the central Piedmont of Virginia. The planting spacing was 9 by 10 feet. The weather had been unusually dry, too dry, really, to be carrying out a prescribed burn. No rain had fallen at the State Forest during the first 20 days of June, up to the day of the burn. During May, we had 2.76 inches, but only an inch had fallen after the first week of May. The planned test burn was only 2 acres, however, and we felt confident we could burn early in the morning without too much trouble.

The test burn was carried out between 9:15 and 10:30 in the morning. The relative humidity was 66 percent when we started and 57 percent when we finished, and the temperature was 75 and 81 degrees at start and finish, respectively. The wind was light, gusting to only 3 or 4 miles per hour. Fire intensity was moderate, with flame heights averaging less than 3 feet, but ranging up to perhaps 6 feet in places. We left the area at lunch time, figuring it was safe.

Sometime during the afternoon, the fire crossed the fireline and burned another 8 acres of the progeny test, upslope of the test burn. This escaped fire burned very hot in places, reaching the crowns in two small spots. In the "hot spots," the bark was burned deeply and drops of pitch exuded on many of the trees with 100 percent crown scorch. The fire consumed stumps and large, dead roots even on the test plot.

For the test plot and the escaped fire together, crown scorch ranged from trees with virtually no needles killed to trees with all of the needles killed. On the test plot, percent of crown scorch (needles killed) ranged from 0 to 80 percent (with the exception of three small, suppressed trees that

had 100 percent crown scorch). This presented us with an opportunity to study the relationship between crown scorch and diameter growth following the burn. Percent of crown scorch was not related to initial DBH, except for the smaller diameter trees that were suppressed or intermediate in crown class (Table 1).

Table 1. Number of trees by initial diameter class, with the average percent crown scorch for each diameter class.

<u>DBH</u>	<u>Number</u>	<u>Average Percent Crown Scorch</u>
1	1	20
2	2	100
3	6	79
4	21	61
5	87	52
6	177	49
7	54	57
8	4	82

PROCEDURE

The progeny test had been laid out in randomized blocks with a 10 seedling row of each family in each block. We selected 20 rows in the initial test burn plot, and another 16 rows in more severely burned areas where the fire escaped, in order to get a full range of crown scorch. On July 3, 13 days after the burn, we estimated the percent of crown scorch to the nearest 10 percent for each tree, also including a 95 percent class. We measured DBH on July 3 and at the end of each growing season, from 1984 through 1988.

TREE MORTALITY

Table 2 shows tree mortality related to percent of crown scorch. Practically all of the mortality occurred in trees in the 95 or 100 percent crown scorch classes, and 20 of 34 trees with 100 percent crown scorch died. Bark beetles played a significant role in the mortality of these trees. The majority of these severely scorched trees made a growth flush after the fire, and appeared as though they would survive, but then were attacked by bark beetles.

DIAMETER INCREMENT

Diameter growth for the remainder of the initial season and the following season was strongly related to percent crown scorch. In succeeding years, however, the relationship weakened rapidly. By the fourth season following the burn, there was no longer any relationship between diameter increment and crown scorch, except, perhaps, for trees with 100 percent crown scorch (Figure 1). The rapid recovery is partly explained by the excellent height growth these young trees were making, which enabled crowns to expand rapidly.

Table 2. Relationship between percent crown scorch, mortality, and diameter growth during the 4½ seasons after the burn.

<u>Percent Crown Scorch</u>	<u>Number of Trees Measured</u>	<u>Percent Mortality</u>	<u>Total 4 1/2 Year Diameter Growth (inches)</u>
0	26	0	.99
10	33	3	.92
20	35	0	.94
30	28	0	.94
40	40	0	.87
50	19	0	.87
60	25	0	.72
70	29	7	.65
80	22	5	.59
90	28	0	.56
95	33	15	.46
100	34	59	.25

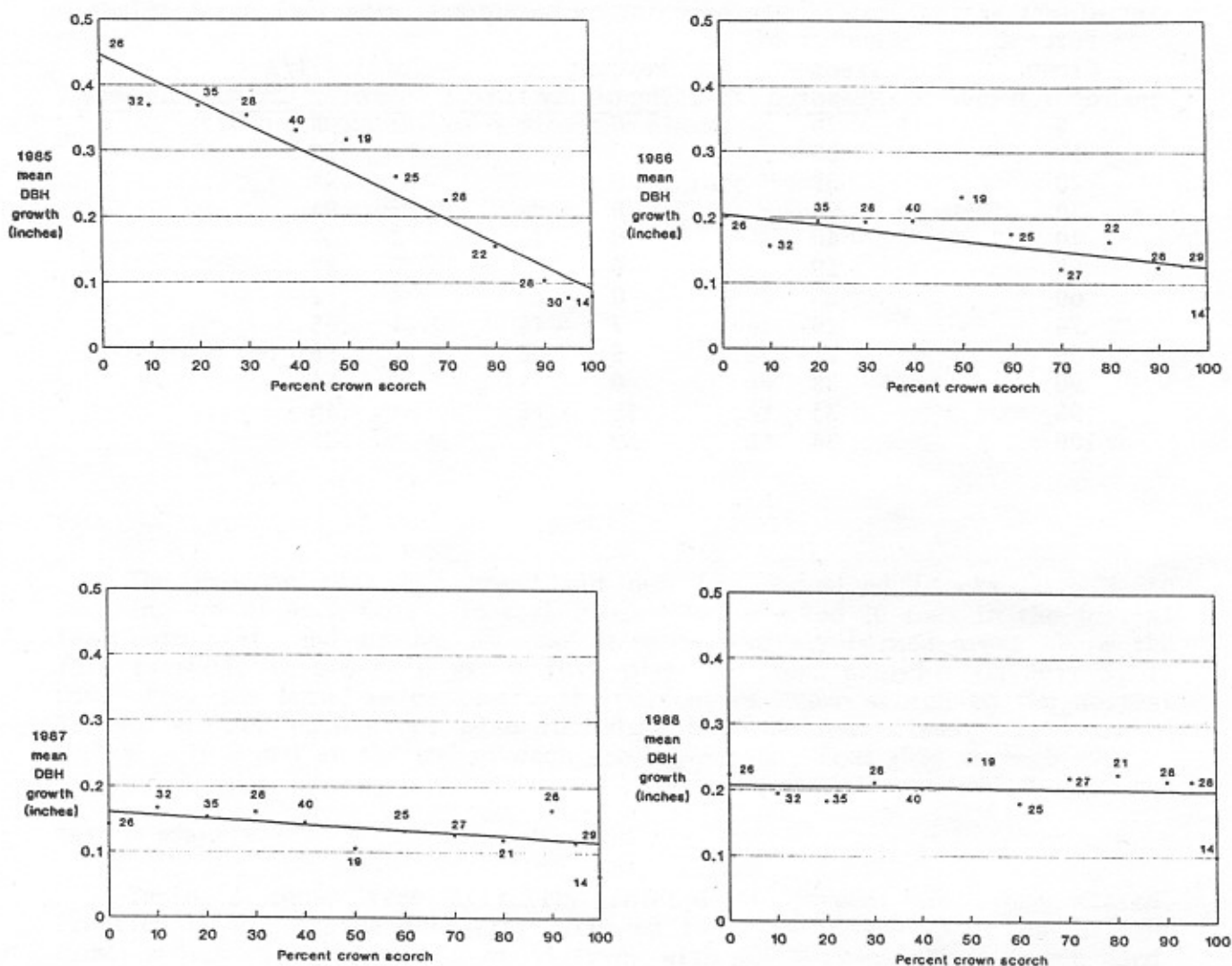


Figure 1. Average annual diameter increment plotted over percent crown scorch. Figures near each data point are number of trees measured. Linear regression lines are fitted to the data.

After four seasons, live crowns were still somewhat shorter in the most severely burned "hot spots," where most of the mortality occurred. This mortality reduced stocking, which would be expected to increase the diameter growth rate of adjacent surviving trees. The trees that benefited from this "release" were mostly in the higher crown scorch classes, perhaps 80 percent or higher. Consequently, the diameter growth rates of these severely scorched trees are probably higher than they would have been had no mortality occurred.

Total diameter growth for the approximately 4½ seasons, from July 3, 1984 through 1988, is presented in Table 2. Total growth loss for trees with 80 percent crown scorch, the highest we had on the test plot, was only .40 inches.

HARDWOOD CONTROL

In the test plot, where the fire burned as we had intended, almost all understory hardwoods up to an inch in basal diameter were killed. Between 1 and 2 inches in diameter, the hardwood kill was only partial, and all hardwoods larger than 2 inches survived. Now, after four years, a dense stand of hardwood sprouts is present, similar in appearance to unburned parts of the plantation.